University of Bahrain
College of Information Technology
Department of Computer Engineering

ITCE 202: Digital Logic
Test I

Time: 1:00 Hour

Date: April 4th, 2005

Question	Marks	Score
1	32	
2	18	
3	24	
4	26	
Total	100	

ID. No.	Name:	Sec.:

Show all your work
DO NOT USE CALCULATORS

Q1

a- (4pts)

Convert $(57.26)_8$ to hexadecimal.

b- (6pts)

Using 8 bits for each number and for the sum, perform the following addition. Indicate if an overflow occurs.

(-99) + (-36)

c- (6 pts)
Convert the following 6-3-1-1 binary weighted code to hexadecimal

$$(10111100.0111)_{6\text{-}3\text{-}1\text{-}1} = (\quad)_{16}$$

d- (6pts)
Add the following two BCD numbers

	0111	0111	1001
+	1001	0010	0101

e- (4pts)
Divide 1110 by 100

f- (6 pts)
Multiply $(12)_4 \times (23)_4 = (\quad)_4$

Q2 (18 points)

a- (10 pts)

Simplify the following expression to a minimum sum of products

$$F = c\ d\ e\ f + \bar{d}\ e\ f + c\ \bar{e}\ f + \bar{a}\ b\ c\ f + e\ f\ g + d\ g$$

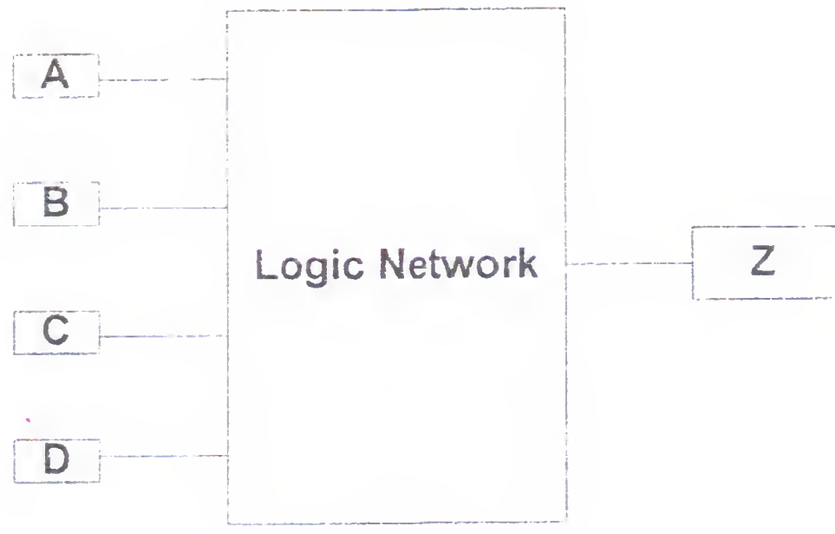
b- (8pts)

Use De Morgan's theorem to find $\overline{F}$ and express in sum of product form

$$F = A\ B\ \left\{ \left[(A \oplus D) + \overline{CG} \right] + \overline{D} \right\}$$

Q4 (24 points)

A logic network accepts four inputs A, B, C, D and generates a single output Z as shown. The output Z will be high if and only if the number of 1's at the inputs is less than or equals to 2, provided that no two adjacent 1's occur at the inputs.



a) (8 pts)
Express the function Z as standard SOP (Decimal form).

b) (6 pts)
Express $\overline{Z}$ in a standard POS (in terms of A, B, C, D).

c) (10 pts)
Draw a 3-level AND-OR-AND circuit that will implement Z.

Q4 (26 points)

(a) (13 pts)

Realize the function Z given by the following Boolean equation using a minimum number of 2-inputs NOR gates only.

$Z = A\overline{B}C\overline{D} + \overline{A}BD + ABC + \overline{A}\,\overline{B}\,\overline{D}$

(b) (13 pts)

For the following Boolean function:

$F = ((\overline{A} + \overline{D}) + B\overline{C})((\overline{B} + C) + AD)$

Find a minimum two-level NAND implementation.